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10/092,358	03/06/2002	Keijo Ruotsalainen	944-005.007	7787

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WARE FRESSOLA VAN DER SLUYS &  
ADOLPHSON, LLP  
BRADFORD GREEN, BUILDING 5  
755 MAIN STREET, P O BOX 224  
MONROE, CT 06468

EXAMINER
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WONG, LINDA

ART UNIT	PAPER NUMBER
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2611

DATE MAILED: 07/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/092,358

Applicant(s)

RUOTSALAINEN ET AL.

Examiner

Linda Wong

Art Unit

2611

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(e). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on 18 April 2006.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-4 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3 is/are rejected.
- 7) ☒ Claim(s) 2 and 4 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

***Response to Arguments***

1. Applicant's arguments filed 4/18/2006 have been fully considered but they are not persuasive.
2. The applicant argues Boutros fails to disclose the limitations "the symbol constellation has a dimensionality that is at least four and is a multiple of two and each symbol of the signal constellation corresponds to an ordered set of at least two sets of two or more numbers, and further wherein for each of the at least four-dimensional symbols, the modulator is configured to modulate the carrier signal using in turn each of the at least two corresponding sets of two or more numbers." The applicant further argues Boutros does not disclose the claimed limitation.
3. The examiner respectfully disagrees.
4. As stated in the office action mailed 1/24/2006, "Claims 1 and 3, Boutros et al discloses a symbol generator (Fig. 2) and a modulator (Fig. 2), the symbol generator for translating a bit stream into a symbol stream based on a predetermined signal constellation (Fig. 2, label u and page 1454, right column, lines 31-33), each symbol in the symbol stream representing a predetermined even number of consecutive bits in the bit stream (Fig. 1 and page 1453, left column, lines 1-6), the modulator using a predetermined modulation scheme to modulate a carrier signal with the symbol stream so as to provide a modulated carrier signal (page 1454, right column, section 11), characterized in that the signal constellation has a dimensionality that is at least four (page 1454, right column, lines 24-26) and is a multiple of two, (page 1454, right column, lines 24-26 and lines 31-40) and,

inherently, that each  $j$  symbol of the signal constellation (30) corresponds to an ordered set of at least two sets of two or more numbers, for each  $I$  and  $Q$  value of the constellation, the magnitude or coefficient or ordered set of coefficients would be the same or different (Fig. 1) and further characterized in that for each of the at least four-dimensional symbols, the modulator, inherently, modulates the carrier signal using in turn each of the at least two corresponding sets of two or more numbers, since the modulator would take each  $I$  and  $Q$  of the constellation and modulate with a carrier signal. (Fig. 2 and page 1454-1455, section 11)"

5. To explain further, the examiner has broken down the recited limitation in claims 1 and 3.
  - a. Regarding limitation "a symbol generator and a modulator, the symbol generator for translating a bit stream into a symbol stream based on a predetermined signal constellation", Boutros discloses a symbol generator (Fig. 2) and a modulator (Fig. 2), wherein the symbol generator uses an  $M$ -ary QAM modulation scheme to transfer a bit stream (Fig. 2, label Info Bits) into symbols (Fig. 2, label  $u$ ) based on a predetermined constellation (Fig. 1 and Section VI, Subsection C).
  - b. Regarding the limitation "each symbol in the symbol stream for representing a predetermined even number of consecutive bits in the bit stream", Boutros discloses the  $M$ -ary QAM scheme, which inherently has symbols with an even number of consecutive bits. (Fig. 1) To further indicate that such a limitation is well known in the art and inherent, the examiner has provided pages from the

- tutorial "All About modulation". On page 41, Table of symbol and bits, the symbol for a 16 QAM modulation scheme is shown. The bits for such symbols are an even number of consecutive bits. (Table of symbol and bits, pages 41)
- c. Regarding the limitation "the modulator configured to use a predetermined modulation scheme to modulate a carrier signal with the symbol stream so as to provide a modulated carrier signal", Boutros discloses a modulator (Fig. 2), which inherently modulates the carrier signal with the symbol stream using a M-ary QAM modulation scheme (Fig. 2, Section II, Section VI, Subsection C). To show evidence of such inherency, documentation from Wireless Communication textbook is provided. On page 325, equation 6.121 shows the equation of the modulated signal,  $S_i(t)$ . From the equation, " $a_i$  and  $b_i$  are a pair of independent integers chosen according to the location of the particular signal point." (page 325, section 6.10.2, line 8-9) This indicates the symbol coordinates of the information signal,  $a_i$  and  $b_i$ , is modulated with a carrier signal to produce  $S_i(t)$ .
- d. Regarding limitation "the signal constellation has a dimensionality that is at least four and is a multiple of two", Boutros discloses a multidimensional QAM modulation (Abstract, Section II, III, VI, subsection C), which inherently comprises a M-dimensional predetermined constellation. An example of an M-dimensional predetermined constellation matching the recited limitations in claims 1 and 3, Boutros discloses a multi-dimensional QAM modulation with a

dimensionality of at 4 (Section VI, Subsection C), and the dimension 4 is a multiple of 2.

- e. Regarding limitation "each symbol of the signal constellation corresponds to an ordered set of at least two sets of two or more numbers, and further wherein each of the least four-dimensional symbols, the modulator is configured to modulate the carrier signal using in turn each of the at least two corresponding sets of two or more numbers", since Boutros discloses a multi-dimensional QAM scheme (page 1453, right column, lines 29-31, Section II) within a modulator (Fig. 2), such a limitation is inherent. To show such proof of inherency, Rappaport is used to explain the QAM scheme. Rappaport discloses the symbol of the signal constellation. (Fig. 6.47, equation 6.125) Each symbol is an ordered set of coordinates (equation 6.126), wherein the coordinates have at least two numbers. (eqn. 6.125, ex.  $(-3,3)$ ,  $(-1,3)$ , etc.) The modulated signal shows that the carrier signal is modulated with  $a_i, b_i$ . (Eqn. 6.121) This shows that the modulator or the output of the modulator or modulated signal comprises a carrier signal modulated with "each of the at least two corresponding sets of two or more numbers".
6. Based on the explanations above, the rejection as stated in the previous office action still stands as stated. A copy of the rejection to claims 1 and 3 mailed 1/24/2006 is included below.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. **Claims 1 and 3** are rejected under 35 U.S.C. 102(b) as being anticipated by

Boutros et al (Publication: "Signal Space Diversity: A Power and Bandwidth Efficient Diversity Technique for the Rayleigh Fading Channel").

- a. **Claims 1 and 3**, Boutros et al discloses a symbol generator (Fig. 2) and a modulator (Fig. 2), the symbol generator for translating a bit stream into a symbol stream based on a predetermined signal constellation (Fig. 2, label u and page 1454, right column, lines 31-33), each symbol in the symbol stream representing a predetermined even number of consecutive bits in the bit stream (Fig. 1 and page 1453, left column, lines 1-6), the modulator using a predetermined modulation scheme to modulate a carrier signal with the symbol stream so as to provide a modulated carrier signal (page 1454, right column, section II), characterized in that the signal constellation has a dimensionality that is at least four (page 1454, right column, lines 24-26) and is a multiple of two, (page 1454, right column, lines 24-26 and lines 31-40) and, inherently, that each  $j$  symbol of the signal constellation (30) corresponds to an ordered set of at least two sets of two or more numbers, for each I and Q value of the constellation, the magnitude or coefficient or ordered set of coefficients would

be the same or different (Fig. 1) and further characterized in that for each of the at least four-dimensional symbols, the modulator, inherently, modulates the carrier signal using in turn each of the at least two corresponding sets of two or more numbers, since the modulator would take each I and Q of the constellation and modulate with a carrier signal. (Fig. 2 and page 1454-1455, section II)

***Allowable Subject Matter***

8. **Claims 2, 4** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Conclusion***

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).
10. A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the



mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Linda Wong whose telephone number is 571-272-6044. The examiner can normally be reached on 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheih Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Linda Wong

P. **KEVIN KIM**  
**PATENT EXAMINER**  
*K. Kim*